

FIBER REINFORCED GLASS SUBSTRATE

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Inventor: ENOMOTO AKIRA

Applicant: IBIDEN CO LTD

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Abstract of JP3095726

PURPOSE: To improve strength, rigidity and surface smoothness by sintering a glass prepreg for one part of matrix glass for which heat resistant inorganic long fiber is two-dimensionally arranged.

CONSTITUTION: The heat resistant inorganic long fiber forms a compound by arranging two-dimensionally in the matrix glass and further, one part of the matrix glass, at least, is obtained by sintering the glass prepreg solution. In such a way, the compound obtains satisfactory adhesivity between the inorganic long fiber and the matrix glass and accordingly, a reinforcing effect is made high and the strength or the rigidity is improved. Since the substrate is covered with a glass material on an external surface, the surface smoothness is made satisfactory. Simultaneously, since a surface layer is made of the glass, high hardness can be obtained.

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Claims:

1. A fiber-reinforced glass substrate, characterized in that the substrate comprises:

a composite layer of a matrix glass and a sheet-shaped molded product wherein heat-resistant inorganic filaments are arranged two-dimensionally, and

a glass surface layer that covers the surface of the composite layer, and that

at least a part of the matrix glass is constituted with a glass formed by firing a glass precursor.

2. A method of manufacturing a fiber-reinforced glass substrate, characterized in that the method comprises at least the following steps of (1) to (3):

(1) a step of obtaining a preform by immersing a sheet-shaped molded product wherein heat-resistant inorganic filaments are arranged two-dimensionally into a solution comprising mainly a glass precursor, and the drying the sheet-shaped molded product to form a matrix glass;

(2) a step of forming a fired composite by firing the dried preform at a temperature of 500°C or more under increased pressure;

(3) a step of forming a smooth surface layer by coating a glass material on the surface of the fired composite.

3. The method according to claim 2, characterized in that each of the immersing treatment with the glass precursor solution and the drying treatment is carried out repeatedly plural times in the operation of the step (1).

4. The method according to claim 2 or 3, characterized in that a glass fine powder is added to the glass precursor solution in the operation of the step (1).

[Examples]

Example 1

(1) A glass precursor solution was prepared by adding and mixing the

prescribed amount of each alkoxide of silicon, boron, and sodium, water for hydrolysis, and ethyl alcohol as a solvent and by concentrating the mixture thereof so that the resultant glass composition contained 75 wt% of SiO_2 , 19 wt% of B_2O_3 and 6 wt% of Na_2O .

(2) Two sheets of cloths of alumina fibers were overlapped, and the overlapped sheet was immersed into the glass precursor solution obtained in the above step (1), and then dried. This treatment was repeated 6 times to give a preform.

(3) The preform obtained in the above step (2) was fired in the air at 750°C under increased pressure so that a fired composite was obtained.

(4) The glass precursor solution obtained in the above step (1) was spin-coated on both surfaces of the fired composite obtained in the above step

(3). Then, the fired composite was dried and fired in the air at 750°C so that a smooth glass surface layer having thickness of $140\text{ }\mu\text{m}$ was formed.

(5) The substrate obtained in the above step (4) was polished using abrasive grains of Al_2O_3 and a lapping machine, and a fiber-reinforced glass substrate of the present invention with R_{max} of $0.01\text{ }\mu\text{m}$ was prepared.

A test for mechanical properties was carried out on the substrate thus obtained, and the substrate showed a tensile strength of 63 kg/mm^2 and a Young's modulus of 8600 kg/mm^2 . It was therefore confirmed that the obtained substrate is a fiber-reinforced glass substrate which has a high strength, Young's modulus and surface smoothness, required for a substrate for a magnetic disk.

Example 2

(1) A glass precursor solution was prepared by adding and mixing the prescribed amount of each alkoxide of silicon, boron, and lead, water for hydrolysis, and ethyl alcohol and an organic acid as a solvent, by adding the same glass fine powder as described above (300 mesh) in an amount of 10 wt%, and by concentrating the mixture thereof so that the resultant glass composition contained 70 wt% of SiO_2 , 18 wt% of B_2O_3 and 12 wt% of PbO .

(2) Two sheets of cloths of silicon carbide fibers were overlapped, and the overlapped sheet was immersed into the glass precursor solution obtained in the above step (1), and then dried. This treatment was repeated 2 times to give a preform.

(3) The preform obtained in the above step (2) was fired in the air at 700°C under increased pressure so that a fired composite was obtained.

(4) The glass precursor solution obtained by the operation before adding the glass fine powder in the above step (1) was spin-coated on both surfaces of the fired composite obtained in the above step (3). Then the fired composite was dried and fired in the air at 700°C so that a smooth glass surface layer having thickness of 180 μm was formed.

(5) The surface of the substrate was polished in a manner similar to Example 1, and a fiber-reinforced glass substrate of the present invention with R_{max} of 0.03 μm was prepared.

A test for mechanical properties was carried out on the substrate thus obtained, and the substrate showed a tensile strength of 58 kg/mm^2 and a Young's modulus of 8100 kg/mm^2 . It was therefore confirmed that the obtained substrate is a fiber-reinforced glass substrate which has a high strength, Young's modulus and surface smoothness, required for a substrate for a magnetic disk.